

What is claimed is:

1        1. An anti-microbial powder coating composition comprising one or more  
2 anti-microbial agents impact fused to particles of a resin-based powder.

1        2. The composition of claim 1 wherein the anti-microbial agent is  
2 substantially entirely impact fused to the surface of the resin-based powder particles.

1        3. The composition of claim 2 wherein the anti-microbial agent is an anti-  
2 microbial metal or metal ion.

1        4. The composition of claim 3 wherein the anti-microbial metal or metal ion  
2 is silver.

1        5. The composition of claim 4 wherein the silver is in the form of a silver ion  
2 carried by a zeolite.

1        6. The composition of claim 4 wherein the silver is supplied by a silver salt.

1        7. The composition of claim 4 wherein the silver is supplied by a silver  
2 zirconium phosphate.

1        8. The composition of claim 4 wherein the silver is supplied by an organic  
2 composition containing silver.

1        9. The composition of claim 5 wherein the powder coating composition  
2 comprises a thermosetting composition based on a cured polyester resin composition.

1           10.     The composition of claim 9 wherein the polyester resin composition is  
2     cured with a triglycidylisocyanurate.

1           11.     The composition of claim 10 wherein the silver containing zeolite is about  
2     1 to 5 percent by weight of the sum of the components comprising the powder coating  
3     composition.

1           12.     The composition of claim 7 wherein the powder coating composition  
2     comprises a thermosetting composition based on a cured epoxy resin composition.

1           13.     The composition of claim 12 wherein the silver zirconium phosphate is  
2     about 1 percent by weight of the sum of the components comprising the powder coating  
3     composition.

1           14.     The composition of claim 5 wherein the powder coating composition  
2     comprises a radiation curable composition based on an ultraviolet curable polyester resin.

1           15.     The composition of claim 14 wherein the ultraviolet curable polyester  
2     resin is an unsaturated polyester resin.

1           16.     The composition of claim 14 wherein the silver zeolite is about 1 to 2  
2     percent by weight of the sum of the components comprising the powder coating  
3     composition.

1           17.     The composition of claim 1 including one or more anti-microbial metal or  
2     metal ions homogeneously dispersed within particles of the powder coating composition.

1           18.     The composition of claim 17 wherein the homogeneously dispersed anti-  
2     microbial metal or metal ion is silver.

1           19.     The composition of claim 18 wherein the homogeneously dispersed silver  
2     is in the form of a silver zirconium phosphate.

1           20.     The composition of claim 18 wherein the homogeneously dispersed silver  
2     is in the form of a silver ion carried by a zeolite.

1           21.     The composition of claim 19 wherein the homogeneously dispersed silver  
2     zirconium phosphate is about 1 percent by weight of the sum of the components  
3     comprising the powder coating composition.

1           22.     The composition of claim 20 wherein the homogeneously dispersed silver  
2     zeolite is about 1 to 5 percent by weight of the powder coating composition.

1           23.     A method for preparing an anti-microbial powder coating composition  
2     comprising impact fusing one or more anti-microbial agents to particles of a resin-based  
3     powder.

1           24.     The method of claim 23 further including absent the anti-microbial agent,  
2     blending the components of the powder coating composition using a premixer, feeding  
3     the mixture into an extruder, heating the mixture to a temperature high enough to melt it,  
4     cooling the melt, and processing the solid extrudate into a coating powder.

1           25.     The method of claim 24 wherein impact fusing includes impact fusing the  
2     anti-microbial agent to the coating powder so that the anti-microbial agent is substantially  
3     entirely fused to the surface of the coating powder particles.

1           26.     The method of claim 24 wherein impact fusing the anti-microbial agent  
2     includes mixing the anti-microbial agent with the coating powder, blending the mixture  
3     in a high intensity mixer, cooling the mixture and processing the mixture into an anti-  
4     microbial coating powder.

1           27.     The method of claim 26 further including adjusting the blending time to  
2     approximately achieve the glass transition temperature.

1           28.     A method for preparing an anti-microbial powder coating composition  
2     comprising blending the components of the powder coating composition using a  
3     premixer, feeding the mixture into an extruder, heating the mixture to a temperature high  
4     enough to melt it, cooling the melt, processing the solid extrudate into a coating powder,  
5     and impact fusing one or more anti-microbial agents to the particles of the coating  
6     powder.

1           29.     The method of claim 28 wherein impact fusing one or more anti-microbial  
2     agents to the particles of the coating powder includes mixing the anti-microbial agent  
3     with the coating powder, blending the mixture in a high intensity mixer, cooling the  
4     mixture and processing the mixture into an anti-microbial coating powder.

1           30.     The method of claim 29 further including adjusting the blending time to  
2     approximately achieve the glass transition temperature.

1           31. An anti-microbial powder coating composition comprising an anti-  
2 microbial silver zirconium phosphate that is homogeneously dispersed within particles of  
3 a resin-based powder.

1           32. The composition of claim 31 wherein the powder coating composition  
2 comprises a thermosetting composition based on a cured polyester resin composition.

1           33. The composition of claim 32 wherein the polyester resin composition is  
2 cured with a urethane curing agent.

1           34. The composition of claim 33 wherein the silver zirconium phosphate is  
2 about 1 percent to 2 percent of the sum of the components comprising the powder coating  
3 composition.

1           35. An anti-microbial powder coating composition comprising one or more  
2 anti-microbial metals or metal ions homogeneously dispersed within particles of a  
3 radiation curable resin-based powder.

1           36. The composition of claim 35 wherein the anti-microbial metal or metal ion  
2 is silver.

1           37. The composition of claim 36 wherein the silver is a silver ion carried by a  
2 zeolite.

1           38. The composition of claim 36 wherein the resin-based powder is  
2 ultraviolet-radiation curable.

1           39.     The composition of claim 38 wherein the resin is a polyester resin.

1           40.     The composition of claim 35 further comprising a cure initiator.

1           41.     The composition of claim 40 wherein the cure initiator is a free radical  
2     producing cure initiator.

1           42.     The composition of claim 40 wherein the cure initiator is a cation  
2     producing cure initiator.

1           43.     The composition of claim 36 wherein the silver zeolite is about 1 to 2  
2     percent by weight of the sum of the components comprising the powder coating  
3     composition.

1           44.     A powder coating composition comprising one or more anti-microbial  
2     metals or metal ions homogeneously dispersed within particles of a resin-based powder,  
3     said resin-based powder formulated such that the components do not inhibit the migration  
4     or decrease the solubility of said anti-microbial metals or metal ions.

1           45.     The powder coating composition of claim 44 wherein the anti-microbial  
2     metal or metal ion is silver.

1           46.     The powder coating composition of claim 45 wherein the silver is in the  
2     form of a silver ion carried by a zeolite.

1           47.     The powder coating composition of claim 45 wherein the component that  
2 inhibits the migration or decreases the solubility of said silver is an ionic halide that is not  
3 already associated with silver.

1           48.     The powder coating composition of claim 47 wherein the concentration of  
2 the ionic halide in the powder coating composition is less than 300 parts per million.

1           49.     The powder coating composition of claim 47 wherein the concentration of  
2 the ionic halide in the powder coating composition is less than 50 parts per million.

1           50.     The powder coating composition of claim 47 wherein the concentration of  
2 the ionic halide in the powder coating composition is less than 10 parts per million.

1           51.     The powder coating composition of claim 47 wherein said ionic halide is  
2 chloride.

1           52.     The powder coating composition of claim 46 wherein said silver zeolite is  
2 about 3 percent to 12 percent by weight of the sum of the components of the powder  
3 coating composition.